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A Summary of Reports of Ulvaceae (Chlorophyta) From Turkey*

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Abstract: A revised list of the taxa of the Ulvaceae occurring in Turkey is reported in this research. A total of 25 taxa of this family is herein reported from Turkey. Also, the transfers of four taxa of *Enteromorpha* to *Ulva* are proposed: *Ulva intestinalis* L. var. *asexualis* (Bliding) E. Taskin comb. nov. (*Enteromorpha intestinalis* var. *asexualis* Bliding, 1963), *Ulva intestinalis* forma *ramosa* (Vinogradova) E. Taskin comb. nov. (*Enteromorpha intestinalis* forma *ramosa* Vinogradova, 1974), *Ulva intestinalis* forma *saprobia* (Vinogradova) E. Taskin comb. nov. (*Enteromorpha intestinalis* forma *saprobia* Vinogradova, 1974) and *Ulva prolifera* subsp. *gullmariensis* (Bliding) E. Taskin comb. nov. (*Enteromorpha prolifera* subsp. *gullmariensis* Bliding, 1963). A total of 25 taxa (species and intraspecific) reported from Turkey.

Key words: *Enteromorpha*, *Ulva*, seaweeds, Turkey

INTRODUCTION

Ulva was one of the first Linnaean genera, and later *Enteromorpha* Link was established to include tubular forms (Hayden *et al.*, 2003). A phylogenetic study based on a combined data set of two genes (nuclear ribosomal internal transcribed spacer DNA and the chloroplast-encoded *rbc L* gene) showed that *Ulva* and *Enteromorpha* together form a strongly supported clade in all analyses, but they are not monophyletic and should not be recognized as separate genera (Hayden *et al.*, 2003). So Hayden *et al.* (2003) both transferred and restored a number of species of *Enteromorpha* to *Ulva*. Bae and Lee's (2001) segregation of *Ulva olivascens* P. Dangeard in the genus *Umbraulva* was also supported by Hayden *et al.*'s (2003) analyses. Recently, Wynne (2005) transferred five additional taxa of *Enteromorpha* to *Ulva*.

The check-list by Gallardo *et al.* (1993) reported 39 taxa of *Ulva sensu lato* at the specific and infraspecific level from the Mediterranean Sea. The first paper in which seaweeds from the Aegean Sea (Turkey) were reported is that by Forsskål (1775), who recorded *Ulva intestinalis* L. from the islands of Gokceada (Imbros) and Bozcaada (Tenedos) (Athanasiadis, 1987). Several studies including or dealing only with the Ulvaceae of the Turkey have

been made by Dural (1989, 1990), Aysel *et al.* (1991), Dural *et al.* (1990, 1992), Aysel and Erdugan (1995), Aysel and Gezerler (1996), Kurt *et al.* (2000), Taskin *et al.* (2003, 2004) and Taskin and Ozturk (2005). The recent general list of the marine algae of Turkey was made by Taskin *et al.* (2001), who recorded 28 taxa of *Enteromorpha* and *Ulva*.

In this study the aim was that to prepare a revised list of the taxa of the Ulvaceae occurring in Turkey.

MATERIALS AND METHODS

Several studies including or dealing only with the Ulvaceae of the Turkey have been made by some researchers. This family has been synthesized by compiling previous records of phycological studies from Turkey.

RESULTS

In this study a revised list of the Ulvaceae of Turkey is given. Turkish *Enteromorpha* species are now included within *Ulva*. Also, the transfer of four infraspecific taxa of *Enteromorpha* to *Ulva* is proposed. Twenty five Ulvaceae are distributed in Turkey (Table 1).

Table 1: List of the Ulvaceae of Turkey (Mediterranean Sea (MS), Aegean Sea (AS), Sea of Marmara (SM) and Black Sea (BS))

Taxa	Localities	References
1. <i>Ulva clathrata</i> (Roth) C. Agardh = <i>Enteromorpha clathrata</i> (Roth) Greville; <i>Ulva muscoides</i> Clemente; <i>E. muscoides</i> (Clemente) Cremades; <i>E. ramulosa</i> (Smith) Hooker; <i>E. crinita</i> (Roth) J. Agardh	MS, AS, SM, BS	Taskin <i>et al.</i> (2004), Dural (1990), Aysel <i>et al.</i> (1991), Aysel and Erdugan (1995)
2. <i>U. compressa</i> L. = <i>Enteromorpha compressa</i> (L.) Nees; <i>E. complanata</i> Kützinger; <i>E. compressa</i> var. <i>usneoides</i> (Bonnemaison ex J. Agardh) Bliding	MS, AS, SM, BS	Lamouroux (1822), Taskin <i>et al.</i> (2004), Dural (1990), Aysel <i>et al.</i> (1991), Aysel and Erdugan (1995)

*In honour of Prof. Dr. Mehmet Ozturk on the occasion of his 50th birthday

Table 1: Continued

Taxa	Localities	References
3. <i>U. curvata</i> (Kützing) De Toni	SM, BS	Aysel <i>et al.</i> (1991), Aysel and Erdugan (1995)
4. <i>U. dactylifera</i> Setchell et Gardner (1)	SM	Aysel <i>et al.</i> (1991)
5. <i>U. fasciata</i> Delile = <i>Ulva lactuca</i> L. forma <i>fasciata</i> (Delile) Hering in Krauss	MS, AS, SM, BS	Taskin <i>et al.</i> (2004), Zeybek <i>et al.</i> (1993), Aysel <i>et al.</i> (1991), Aysel and Erdugan (1995)
6. <i>U. fenestrata</i> Postels et Ruprecht (1)	SM, BS	Aysel <i>et al.</i> (1991), Ozturk (1998)
7. <i>U. flexuosa</i> Wulfen subsp. <i>flexuosa</i> = <i>Enteromorpha flexuosa</i> (Wulfen) J.Agardh subsp. <i>flexuosa</i> ; <i>E. lingulata</i> J.Agardh; <i>E. plumosa</i> Kützing	MS, AS, SM, BS	Aysel and Gezerler (1996), Zeybek <i>et al.</i> (1993), Aysel <i>et al.</i> (1991), Aysel and Erdugan (1995)
8. <i>U. flexuosa</i> Wulfen subsp. <i>pilifera</i> (Kützing) M.J. Wynne = <i>Enteromorpha flexuosa</i> subsp. <i>pilifera</i> (Kützing) Bliding	AS	Dural <i>et al.</i> (1992)
9. <i>U. intestinalis</i> L. <i>Enteromorpha intestinalis</i> (L.) Nees	MS, AS, SM, BS	Taskin <i>et al.</i> (2004), Zeybek <i>et al.</i> (1993), Aysel <i>et al.</i> (1991), Aysel and Erdugan (1995)
10. <i>U. intestinalis</i> L. var. <i>asexualis</i> (Bliding) E. Taskin comb. nov. (2) = <i>Enteromorpha intestinalis</i> var. <i>asexualis</i> Bliding	SM	Aysel <i>et al.</i> (1991)
11. <i>U. intestinalis</i> L. forma <i>cylindracea</i> (J.Agardh) M.J. Wynne = <i>Enteromorpha intestinalis</i> var. <i>cylindracea</i> J.Agardh (1)	AS, SM	Dural (1990), Aysel <i>et al.</i> (1991)
12. <i>U. intestinalis</i> forma <i>ramosa</i> (Vinogradova) E. Taskin comb. nov. (3) = <i>Enteromorpha intestinalis</i> forma <i>ramosa</i> Vinogradova	AS	Dural (1990)
13. <i>U. intestinalis</i> forma <i>saprobia</i> (Vinogradova) E. Taskin comb. nov. (4) = <i>Enteromorpha intestinalis</i> forma <i>saprobia</i> Vinogradova	SM, BS	Aysel <i>et al.</i> (1991), Aysel and Erdugan (1995)
14. <i>U. kyllinii</i> (Bliding) Hayden, Blomster, Maggs, P.C. Silva, Stanhope and Waaland= <i>Enteromorpha kyllinii</i> Bliding Aysel <i>et al.</i> (1991), Aysel and Erdugan (1995)	MS, AS, SM, BS	Aysel and Gezerler (1996), Zeybek <i>et al.</i> (1993),
15. <i>U. lactuca</i> L. (5) Zeybek <i>et al.</i> (1993), Aysel <i>et al.</i> (1991)	MS, AS, SM, BS	Lamouroux (1822), Aysel and Gezerler (1996),
16. <i>U. linza</i> L. = <i>Ulva lanceolata</i> L.; <i>Enteromorpha linza</i> (L.) J.Agardh; <i>E. bertolonii</i> Montagne; <i>Ulva crispata</i> Bertoloni; <i>Enteromorpha linza</i> var. <i>crispata</i> (Bertoloni) J.Agardh	MS, AS, SM, BS	Lamouroux (1822), Taskin <i>et al.</i> (2004), Kurt <i>et al.</i> (2000), Zeybek <i>et al.</i> (1993), Aysel <i>et al.</i> (1991)
17. <i>U. procera</i> (K. Ahlner) Hayden, Blomster, Maggs, Silva, Stanhope and Waaland = <i>Enteromorpha ahneriana</i> Bliding (6)	SM, BS	Aysel <i>et al.</i> (1991), Aysel and Erdugan (1995)
18. <i>U. prolifera</i> O.F. Müller subsp. <i>prolifera</i> = <i>Enteromorpha polyclados</i> Kützing; <i>E. prolifera</i> (O.F. Müller) J.Agardh subsp. <i>prolifera</i>	MS, AS, SM, BS	Aysel and Gezerler (1996), Zeybek <i>et al.</i> (1993), Aysel <i>et al.</i> (1991), Aysel and Erdugan (1995)
19. <i>U. prolifera</i> subsp. <i>gullmariensis</i> (Bliding) E. Taskin comb. nov. (7) = <i>Enteromorpha prolifera</i> subsp. <i>gullmariensis</i> Bliding	AS	Dural <i>et al.</i> (1992)
20. <i>U. radiata</i> (J. Agardh) Hayden, Blomster, Maggs, Silva, Stanhope and Waaland = <i>Enteromorpha radiata</i> J. Agardh; <i>E. prolifera</i> subsp. <i>radiata</i> (J.Agardh) Bliding	AS	Dural (1990)
21. <i>U. rigida</i> C.Agardh forma <i>rigida</i> = <i>Ulva spathulata</i> Papenfuss	MS, AS, SM, BS	Zeybek <i>et al.</i> (1993), Taskin <i>et al.</i> (2003), Aysel and Erdugan (1995)
22. <i>U. rigida</i> forma <i>densa</i> (Kjellman) Feldmann	AS, SM	Zeybek <i>et al.</i> (1993), Aysel <i>et al.</i> (1991)
23. <i>U. taeniata</i> (Setchell) Setchell in Gardner (8) = <i>Ulva fasciata</i> var. <i>taeniata</i> Setchell	MS, AS	Zeybek <i>et al.</i> (1993), Taskin <i>et al.</i> (2004)
24. <i>U. torta</i> (Mertens) Trevisan = <i>Conferva torta</i> Mertens in Jurgens; <i>Enteromorpha torta</i> (Mertens) Reinbold (6)	AS	Dural <i>et al.</i> (1992)
25. <i>Umbraculva olivascens</i> (P. Dangeard) Bae et I.K. Lee = <i>Ulva olivascens</i> P. Dangeard	SM	Aysel <i>et al.</i> (1991)

DISCUSSION

Some taxa of *Enteromorpha* that have been recorded from Turkey by several studies are excluded from the present list. Hayden *et al.* (2003) reported that *Enteromorpha multiramosa* Bliding is an invalid name because Bliding did not cite a type. But *Enteromorpha multiramosa* was treated as distinct species by Guiry (2006). *Enteromorpha muscoides* (Clemente) Cremades based on *Ulva muscoides* Clemente was reported as conspecific with *Enteromorpha clathrata* (Roth) Greville (= *Ulva clathrata* (Roth) C. Agardh] by Wynne (2005).

Enteromorpha linza (L.) J.Agardh var. *minor* Schiffner and *Enteromorpha prolifera* (O.F. Müller) J. Agardh f. *subsimplax* Schiffner were reported as *Nomina nuda* by Furnari *et al.* (1999). *Enteromorpha prolifera* (O.F. Müller) J.Agardh var. *tenuis* Schiffner forma *ramosa* Schiffner was recorded as a *taxon inquirendum* by Furnari *et al.* (1999). However, *Enteromorpha coziana* P. Dangeard var. *coziana* and *Enteromorpha coziana* var. *arcassonensis* P. Dangeard were reported from Turkey by Zeybek *et al.* (1993), but *E. coziana* P. Dangeard var. *coziana* was reported as of uncertain taxonomic status by Guiry (2006).

Notes:

1. The presence of this taxon in the Mediterranean Sea needs to be confirmed.
2. The following transfer is proposed: *Ulva intestinalis* L. var. *asexualis* (Bliding) E. Taskin comb. nov.

Basionym: *Enteromorpha intestinalis* var. *asexualis* Bliding, 1963: 141, Fig. 89 and 90.

3. The following transfer is proposed: *Ulva intestinalis* forma *ramosa* (Vinogradova) E. Taskin comb. nov.

Basionym: *Enteromorpha intestinalis* forma *ramosa* Vinogradova, 1974: 88, pl. XXVII, Fig. 1-9.

4. The following transfer is proposed: *Ulva intestinalis* forma *saprobia* (Vinogradova) E. Taskin comb. nov.

Basionym: *Enteromorpha intestinalis* forma *saprobia* Vinogradova, 1974: 86, pl. XXVI, Fig. 1-10.

5. According to Gallardo *et al.* (1993), the presence of this species in the Mediterranean Sea needs to be confirmed.
6. Burrows (1991) included both *Enteromorpha torta* (Mertens) Reinbold and *Enteromorpha ahlneriana* Bliding in *E. prolifera* (= *Ulva prolifera* O.F. Müller), but I follow Gallardo *et al.* (1993).
7. The following transfer is proposed: *Ulva prolifera* subsp. *gullmariensis* (Bliding) E. Taskin comb. nov.

Basionym: *Enteromorpha prolifera* subsp. *gullmariensis* Bliding (1963): 61, Fig. 29.

8. Wynne (2002) stated that *Ulva taeniata* (Setchell) Setchell in Gardner is probably a taxonomic synonym of *Ulva nematoidea* Bory.

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